

PRELIMINARY DATA SUMMARY

March 1992

U.S. Army Engineer Waterways Experiment Station
Coastal Engineering Research Center
Field Research Facility
Duck, North Carolina

PRELIMINARY DATA SUMMARY

CERC Field Research Facility
Duck, North Carolina

This report provides a summary of basic oceanographic, meteorological and bottom profile data for the month. The data were obtained as part of the Measurements and Analysis work units at the U.S. Army Engineer Waterways Experiment Station, Coastal Engineering Research Center's Field Research Facility (FRF) in Duck, North Carolina. The FRF staff collected and analyzed these data. These summaries are intended to make the data readily available to all FRF users, and comments on their content and usefulness are invited.

CONTENTS

	<u>Page</u>
TABLE OF CONTENTS.....	1
PART I: INTRODUCTION.....	2
PART II: METEOROLOGICAL DATA.....	6
PART III: WAVE DATA.....	9
PART IV: CURRENT DATA.....	13
PART V: SUPPLEMENTAL OBSERVATIONS.....	21
PART VI: WATER LEVELS.....	23
PART VII: NEARSHORE PROFILES AND BATHYMETRY.....	26
PART VIII: SPECIAL EVENTS.....	29

LIST OF FIGURES

<u>No.</u>		<u>Page</u>
1	FRF location map.....	3
2	Instrument locations at FRF.....	5
3	Time history of wave heights and periods.....	12
4	Water level time history	24
5	CRAB profiles.....	26
6	CRAB profile envelope.....	27
7	FRF bathymetry (25 Mar 92).....	28

LIST OF TABLES

<u>No.</u>		<u>Page</u>
1	Instrument Status/Data Availability.....	4
2	Meteorological Data.....	7
3	Wave Data.....	10
4	Current Data.....	14
5	Supplemental Observations.....	22
6	Water Levels.....	25

PART I: INTRODUCTION

The U.S. Army Engineer Waterways Experiment Station, Coastal Engineering Research Center's (CERC) Field Research Facility (FRF) is located on the Outer Banks of North Carolina, near the village of Duck (Figure 1).

The FRF research program provides a means for obtaining high-quality field data, particularly during storms, in support of the U.S. Army Corps of Engineers' coastal engineering research missions. The research pier is a reinforced concrete structure supported on 0.9-m-diam steel piles spaced 12.2 m apart along the pier's length and 4.6 m apart across the width. The pier deck is 6.1 m wide and extends from behind the duneline to about the 6-m water depth contour at a height of 7.6 m above the National Geodetic Vertical Datum (NGVD). In addition, a main building contains offices, an instrument repair shop, and a data acquisition room.

One of the responsibilities of the FRF research program is the collection, analysis and dissemination of data on local oceanographic and meteorological conditions. Bottom profiles along both sides of the pier and periodic bathymetric surveys are also performed.

This summary is intended to provide basic data as soon as possible after they are obtained. Questions and/or comments concerning the data may be directed to Mr. Clifford F. Baron at (919) 261-3511.

Part II presents the meteorological data; Parts III through VI present oceanographic data; Part VII presents nearshore profiles and bathymetry; and Part VIII, if included, documents special events that occurred at the FRF during the month.

Table 1 is a list of instruments used, their operational status during the month, and the data collection status. Figure 2 identifies the location of the instruments. The water depths at the wave gages and current meters vary and may be determined from information contained in Figure 7. Other installation information is contained in Table 1.

Times given in the report, unless otherwise specified, are referenced to eastern standard time (EST).

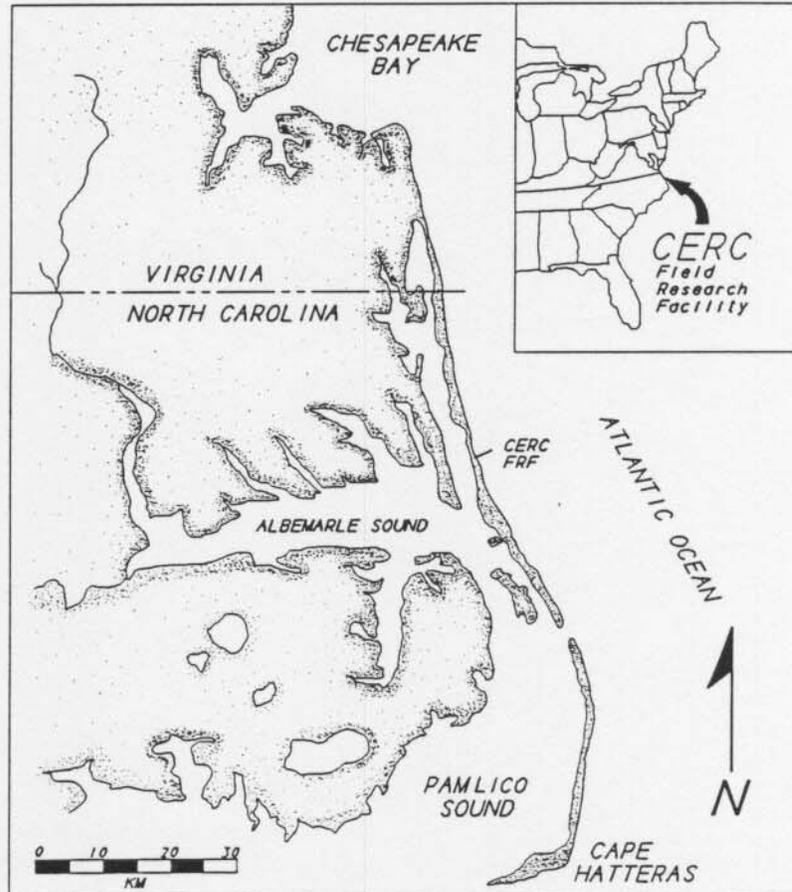


Figure 1. FRF location map.

PART II: METEOROLOGICAL DATA

A variety of instruments have been installed at the FRF (Figure 2) to monitor the meteorological conditions. The data presented in Table 2 are collected and stored using a Digital Equipment Corporation VAX 11/750. For each instrument identified in Table 1 as having analog outputs, chart records are obtained, a log is maintained and the records are stored for future reference.

Winds were measured at the end of the pier at an elevation of 19 m (Figure 2) using a Weather Measure Skyvane anemometer.

Monthly resultant wind speeds and directions are determined by vector averaging the data. Temperature and atmospheric pressure means are the average of the values presented for the month. Total precipitation is the sum for the month.

The following may be useful for converting the data in Table 2 to other frequently used units of measurement:

1. Millimeters (mm) to inches (in.) -
 $\text{mm} \times .03937 = \text{in.}$
2. Millibars (mb) to inches of mercury (in. Hg) -
 $\text{mb} \times 0.02953 = \text{in. Hg}$
3. Degrees Celsius (C) to degrees Fahrenheit (F) -
 $(C \times 9/5) + 32 = F$
4. Meters per second (m/s) to knots (kn) -
 $\text{m/s} \times 1.943 = \text{kn}$

Table 2: Meteorological Data

Mar 1992

Day	Hour	Wind Speed m/sec	Wind Direction deg TN	Temperature deg C	Atm Pressure mb	Precipitation mm
1	100	4	29	4.5	1020.9	0
	700	4	169	3.9	1023.0	0
	1300	5	240	12.7	1020.3	0
	1900	6	196	12.1	1017.9	0
2	100	5	231	11.9	1018.2	0
	700	5	228	10.5	1019.2	0
	1300	3	151	17.2	1018.9	0
	1900	4	166	10.2	1017.5	0
3	100	5	216	13.2	1016.9	0
	700	5	246	12.6	1016.5	0
	1300	8	25	7.4	1018.9	0
	1900	7	34	7.2	1019.6	0
4	100	5	68	8.6	1020.6	0
	700	5	19	8.9	1021.3	0
	1300	7	9	9.0	1021.9	0
	1900	7	8	8.2	1023.0	0
5	100	6	353	8.7	1022.6	0
	700	5	349	9.0	1023.0	0
	1300	3	345	9.5	1023.0	0
	1900	4	9	9.4	1022.3	0
6	100	2	14	8.6	1020.9	0
	700	3	38	9.4	1021.6	0
	1300	3	112	12.8	1020.3	0
	1900	6	148	11.2	1019.2	0
7	100	8	146	11.7	1015.9	0
	700	19	148	13.9	1011.1	0
	1300	8	151	13.5	1009.8	0
	1900	3	188	11.5	1006.7	0
8	100	4	240	14.8	1007.4	0
	700	4	274	14.7	1007.7	0
	1300	0		16.6	1009.1	0
	1900	3	144	11.8	1011.1	0
9	100	1	303	12.3	1013.1	0
	700	6	349	12.0	1015.5	0
	1300	5	21	14.7	1015.9	0
	1900	5	96	10.6	1015.5	0
10	100	3	127	10.7	1013.8	0
	700	5	154	12.2	1010.1	0
	1300	9	191	21.5	1005.7	0
	1900	9	183	18.9	1002.0	0
11	100	11	158	16.4	994.2	15
	700	12	237	14.5	992.5	0
	1300	11	272	7.9	998.6	0
	1900	11	278	6.1	1003.7	0
12	100	8	285	2.6	1007.0	0
	700	7	281	1.2	1009.8	0
	1300	8	246	8.3	1007.7	0
	1900	5	264	9.7	1007.4	0
13	100	5	233	9.0	1007.0	0
	700	9	23	6.2	1007.4	0
	1300	7	1	4.4	1009.4	0
	1900	3	107	3.5	1010.1	0
14	100	4	307	3.8	1012.1	0
	700	5	320	2.5	1014.5	0
	1300	5	253	6.3	1011.8	0
	1900	7	269	7.7	1010.4	0
15	100	8	272	6.4	1010.8	0
	700	7	292	4.8	1012.1	0
	1300	4	36	6.2	1011.8	0
	1900	7	50	4.9	1011.8	0
16	100	13	1	3.5	1013.8	0
	700	13	326	-0.4	1019.2	0
	1300	10	342	2.2	1020.9	0
	1900	5	336	1.3	1021.3	0

* electronic problems

(Continued)

Table 2: Meteorological Data

Mar 1992

Day	Hour	Wind Speed	Wind Direction	Temperature	Atm Pressure	Precipitation
		m/sec	deg TN	deg C	mb	mm
17	100	4	179	0.7	1020.9	0
	700	6	219	5.9	1019.9	0
	1300	9	213	13.6	1015.5	0
	1900	8	196	12.2	1012.8	0
18	100	5	221	10.3	1014.5	0
	700	6	41	9.5	1017.5	0
	1300	8	56	9.8	1017.2	0
	1900	5	45	8.6	1014.5	0
19	100	7	204	14.0	1008.4	0
	700	7	187	14.1	1002.6	0
	1300	9	253	18.6	996.5	0
	1900	13	351	8.2	1001.3	0
20	100	11	354	4.4	1008.1	0
	700	9	22	4.6	1009.8	0
	1300	9	1	5.4	1008.4	0
	1900	12	351	5.4	1008.7	0
21	100	12	353	5.3	1011.8	0
	700	3	288	4.2	1013.1	0
	1300	2	22	8.4	1013.8	0
	1900	8	30	5.6	1015.9	0
22	100	5	78	5.4	1016.5	0
	700	7	107	6.2	1014.8	0
	1300	5	156	10.7	1008.1	0
	1900	7	206	12.5	1003.0	0
23	100	4	249	11.0	1002.6	0
	700	15	355	6.0	1004.7	6
	1300	13	352	4.3	1007.7	3
	1900	9	14	4.6	1012.8	0
24	100	11	354	3.7	1017.5	0
	700	5	17	4.2	1021.6	0
	1300	3	61	6.6	1023.6	0
	1900	5	86	5.0	1025.3	0
25	100	3	171	3.9	1026.7	0
	700	2	118	7.4	1027.4	0
	1300	6	97	10.7	1025.0	0
	1900	9	132	9.4	1021.3	0
26	100	5	130	9.2	1017.9	0
	700	7	113	10.0	1012.8	0
	1300	9	136	12.5	1003.7	24
	1900	7	255	12.4	1002.6	15
27	100	5	241	10.1	1006.0	0
	700	6	214	10.6	1007.0	0
	1300	5	242	14.5	1005.4	0
	1900	9	307	9.0	1008.4	0
28	100	8	278	5.9	1012.1	0
	700	7	287	5.9	1016.2	0
	1300	8	280	12.8	1013.1	0
	1900	4	260	11.1	1013.1	0
29	100	6	310	8.3	1015.9	0
	700	6	329	7.8	1018.6	0
	1300	4	31	10.8	1018.6	0
	1900	6	192	11.2	1017.9	0
30	100	4	215	10.7	1016.9	0
	700	5	208	11.3	1016.5	0
	1300	6	150	14.5	1012.5	0
	1900	6	189	16.5	1008.7	0
31	100	4	202	15.1	1004.7	3
	700	3	300	14.2	1003.3	0
	1300	13	341	8.0	1007.0	0
	1900	3	334	8.2	1008.4	0
		<u>Resultant</u>		<u>Mean</u>	<u>Mean</u>	<u>Total</u>
		1	307	9.2	1013.2	66

PART III: WAVE DATA

Wave data are collected from two Baylor staff gages (Gages 625 and 645), a pressure wave gage (Gage 111) and a Waverider buoy (Gage 630) as shown in Table 1 and Figure 2. The data are collected, analyzed, and stored on optical disc using a Digital Equipment Corporation VAX 11/750 programmed to sample the wave gages every 3 hr. This report reflects the data collection periods of 0100, 0700, 1300, and 1900 EST. The results are based only on the first 34 minute record. The sampling rate is two times per second for five contiguous 34-min records.

Wave height H_{m0} is an energy-based statistic equal to four times the standard deviation of the sea surface elevations. Wave height reported from the pressure gage has been compensated for hydrodynamic attenuation using linear wave theory. Wave period is identified from the computation of a variance (energy) spectrum with 60 deg of freedom calculated from a 34-min record. Peak wave period T_p is defined as the period associated with the maximum energy in the spectrum. When this analysis is complete, the data are written to optical disc.

Table 3 presents the wave heights and periods for each wave record obtained at 6 hr intervals during the month. The monthly means and standard deviations from the means shown in Table 3 are average values computed from this data. Figure 3 is a time history of all H_{m0} and T_p values obtained for all gages.

Differences in wave periods between wave gages (Table 3 and Figure 3) may be the result of wave breaking, wave reformation, or the presence of multiple wave trains containing nearly equal energy.

Table 3: Wave Data

Mar 1992

Day	Hour	645		625		111		630	
		Baylor at 7+80 Hmo.m	T.sec	Baylor at 18+60 Hmo.m	T.sec	Pressure Gage Hmo.m	T.sec	Offshr Wvrdr Hmo.m	T.sec
1	0100	0.50	5.95	1.07	9.14	1.03	8.83		
	0700	0.50	6.09	0.73	8.53	0.71	8.00		
	1300	0.36	7.76	0.55	7.76	0.53	7.31		
	1900	0.17	8.83	0.40	10.67	0.40	10.24		
2	0100	0.23	8.53	0.30	10.24	0.32	11.13		
	0700	0.22	6.40	0.26	9.85	0.29	10.67		
	1300	0.28	7.11	0.27	10.24	0.27	9.85		
	1900	0.32	9.14	0.28	9.85	0.31	10.24		
3	0100	0.24	10.24	0.28	10.67	0.29	10.24		
	0700	0.34	10.24	0.36	10.24	0.37	7.31		
	1300	0.56	2.75	0.79	6.92	0.74	7.11	0.89	6.74
	1900	0.90	5.12	0.99	4.66	0.99	4.92	1.16	4.57
4	0100	0.56	5.69	0.88	5.57	0.91	6.24	1.02	6.09
	0700	0.63	5.82	0.73	5.82	0.75	5.95	0.85	6.24
	1300	0.60	5.33	0.91	7.53	0.97	8.00	1.05	7.31
	1900	0.77	9.14	1.01	8.00	0.99	7.76	1.09	8.00
5	0100	0.56	9.48	0.89	8.26	0.90	8.26	0.98	8.00
	0700	0.66	9.48	0.86	9.14	0.84	8.26	0.92	8.83
	1300	0.43	9.48	0.69	8.53	0.70	8.00	0.76	8.26
	1900	0.53	9.48	0.68	7.53	0.66	9.14	0.71	8.83
6	0100	0.34	9.48	0.53	10.24	0.56	9.85	0.62	9.14
	0700	0.48	9.85	0.54	10.24	0.51	8.26	0.61	9.85
	1300	0.45	4.57	0.54	9.85	0.52	9.48	0.64	10.24
	1900	0.63	9.48	0.60	10.24	0.55	9.48	0.70	9.48
7	0100	0.75	6.74	0.92	6.09	0.82	6.74	1.12	6.56
	0700	1.92	7.11	2.01	7.31	2.05	6.09	2.54	6.92
	1300	1.37	9.48	1.61	8.53	1.69	8.83	1.97	8.83
	1900	1.96	9.85	1.94	10.24	2.05	9.48	2.25	9.85
8	0100	1.34	9.48	1.57	10.67	1.52	9.85	1.79	9.85
	0700	1.55	10.67	1.50	9.85	1.50	9.85	1.70	10.24
	1300	0.77	9.85	1.16	10.24	1.29	10.24	1.38	10.24
	1900	1.06	9.85	1.19	10.67	1.27	10.67	1.45	10.24
9	0100	0.80	9.85	1.08	10.67	1.03	9.85	1.09	10.67
	0700	0.59	9.85	0.92	9.85	1.10	9.48	1.04	11.13
	1300	0.49	10.67	1.02	10.24	1.06	11.13	1.04	10.24
	1900	0.59	10.24	0.90	10.24	0.98	9.85	1.07	9.85
10	0100	0.75	9.85	0.82	9.85	0.99	11.64	1.04	11.64
	0700	0.40	9.48	0.79	9.85	0.87	10.24	0.98	10.24
	1300	0.80	9.48	0.89	10.24	0.91	10.24	1.12	10.24
	1900	0.73	6.24	0.93	9.85	0.96	9.85	1.20	9.48
11	0100	1.26	8.26	1.06	9.48	1.06	10.24	1.35	9.85
	0700	0.72	9.85	0.92	10.24	0.94	9.85	1.24	9.14
	1300	0.61	10.67	0.66	10.24	0.69	9.85	0.97	10.24
	1900	0.32	9.85	0.67	10.24	0.64	10.24	0.98	10.24
12	0100	0.54	9.85	0.61	9.14	0.62	10.24	0.97	9.14
	0700	0.35	9.14	0.51	10.24	0.53	9.85	0.79	9.14
	1300	0.26	9.85	0.44	10.24	0.45	9.48	0.65	10.67
	1900	0.26	9.48	0.37	9.48	0.38	9.85	0.44	9.48
13	0100	0.39	8.83	0.37	9.14	0.40	9.14	0.38	9.14
	0700	0.37	2.81	0.60	2.78	0.39	11.13	0.48	11.13
	1300	0.87	5.45	1.05	5.57	1.06	5.57	1.32	5.69
	1900	0.57	5.12	0.84	5.95	0.81	6.09	1.02	5.57
14	0100	0.57	5.02	0.61	12.80	0.59	11.64	0.70	10.67
	0700	0.53	5.02	0.84	5.45	0.88	5.22	1.08	4.74
	1300	0.47	5.69	0.61	5.57	0.71	5.45	0.92	5.69
	1900	0.18	4.74	0.38	11.13	0.40	11.13	0.47	11.13
15	0100	0.13	8.53	0.24	10.67	0.29	10.67	0.34	9.14
	0700	0.18	9.85	0.20	10.67	0.23	10.24	0.38	10.24
	1300	0.18	2.78	0.38	3.66	0.32	10.24	0.47	3.61
	1900	0.48	5.02	0.58	5.02	0.48	4.92	0.65	4.92
16	0100	0.97	4.66	1.27	4.83	1.24	4.83	1.83	5.12
	0700	1.45	6.09	1.53	6.56	1.57	6.40	1.76	6.40
	1300	0.95	6.24	1.28	6.56	1.29	6.40	1.58	6.74
	1900	0.89	6.40	0.94	5.95	0.93	6.56	1.05	6.56

* Electronic problems

(Continued)

Table 3: Wave Data

Mar 1992

Day	Hour	645		625		111		630	
		Baylor at 7+80 Hmo.m	T.sec	Baylor at 18+60 Hmo.m	T.sec	Pressure Gage Hmo.m	T.sec	Offshwr Wvrdr Hmo.m	T.sec
17	0100	0.50	5.12	0.88	7.11	0.85	6.92	0.93	8.00
	0700	0.45	9.14	0.57	8.83	0.62	9.14	0.75	9.14
	1300	0.19	9.14	0.43	9.48	0.47	9.48	0.63	8.83
	1900	0.47	5.45	0.44	15.06	0.39	14.22	0.62	4.66
18	0100	0.20	7.53	0.27	14.22	0.25	13.47	*	
	0700	0.28	7.31	0.27	14.22	0.26	7.76	0.35	7.11
	1300	0.74	4.57	0.90	4.41	0.76	4.41	0.93	4.27
	1900	0.74	5.02	0.94	4.83	0.86	5.02	1.02	5.02
19	0100	0.53	5.82	0.71	5.45	0.72	5.82	0.90	5.69
	0700	0.52	6.09	0.64	6.09	0.68	6.24	0.79	6.40
	1300	0.59	13.47	0.66	13.47	0.77	12.80	0.94	12.80
	1900	1.10	4.57	1.30	4.41	1.33	4.49	1.62	4.66
20	0100	1.14	6.56	1.62	6.56	1.83	7.11	1.97	6.92
	0700	1.22	5.82	1.48	6.92	1.57	8.00	1.73	8.00
	1300	0.88	9.85	1.47	10.24	1.47	9.48	1.57	10.24
	1900	1.12	10.24	1.60	10.24	1.61	10.24	*	
21	0100	1.09	5.69	1.63	10.67	1.81	11.13	*	
	0700	1.24	12.19	1.59	11.13	1.60	11.64	1.84	11.64
	1300	0.95	11.64	1.34	11.64	1.52	11.13	1.60	12.19
	1900	1.25	11.64	1.62	11.13	1.63	11.64	1.71	11.13
22	0100	0.89	12.19	1.40	12.19	1.48	11.64	1.51	11.13
	0700	1.35	12.19	1.61	11.64	1.65	12.19	1.59	11.64
	1300	0.98	12.19	1.28	11.64	1.34	12.19	1.38	12.19
	1900	0.85	12.19	1.17	11.64	1.14	11.64	*	
23	0100	0.95	12.80	1.08	12.80	1.12	12.80	1.21	12.19
	0700	1.18	14.22	1.53	13.47	1.59	13.47	1.66	13.47
	1300	1.55	6.09	1.81	13.47	1.79	5.82	2.07	6.09
	1900	1.17	6.24	1.46	12.80	1.48	6.09	1.62	12.80
24	0100	1.31	6.24	1.46	13.47	1.46	4.83	1.97	12.80
	0700	0.65	5.95	1.10	12.19	1.20	12.19	1.34	12.19
	1300	0.71	5.57	0.87	10.24	0.97	11.64	1.04	12.19
	1900	0.40	10.67	0.84	10.24	0.79	10.67	0.93	10.24
25	0100	0.71	10.24	0.77	11.13	0.73	9.85	0.97	10.24
	0700	0.41	9.85	0.70	10.67	0.71	11.13	0.80	8.83
	1300	0.52	9.85	0.72	10.24	0.75	12.80	0.80	8.26
	1900	0.57	3.51	0.84	9.48	0.75	10.24	1.30	10.24
26	0100	0.81	4.92	0.82	9.14	0.77	11.64	1.01	5.12
	0700	0.95	6.74	1.19	7.11	1.28	6.92	1.43	6.40
	1300	1.97	9.48	2.17	9.14	2.16	9.14	2.39	9.14
	1900	1.59	12.19	2.82	11.13	2.66	11.13	3.91	11.13
27	0100	1.97	11.64	2.27	11.64	2.32	12.19	3.25	11.64
	0700	1.46	12.19	1.80	11.13	1.73	11.64	1.98	11.13
	1300	1.74	11.13	1.92	11.13	1.81	12.19	1.92	11.66
	1900	1.19	11.13	1.32	11.64	1.46	11.64	2.04	11.13
28	0100	0.85	11.13	1.09	11.64	1.09	11.64	1.31	11.64
	0700	0.45	11.64	0.87	11.64	1.02	11.13	1.08	11.66
	1300	0.61	10.67	0.88	11.13	0.94	12.80	1.04	13.47
	1900	0.29	10.24	0.66	11.64	0.70	12.19	0.84	10.67
29	0100	0.31	11.64	0.54	12.19	0.59	11.64	0.69	11.64
	0700	0.56	5.22	0.91	5.82	0.91	5.82	1.06	5.45
	1300	0.59	5.82	0.97	5.69	0.98	6.40	1.15	6.56
	1900	0.25	5.69	0.63	7.53	0.63	7.31	0.88	7.31
30	0100	0.17	5.45	0.37	6.92	0.38	11.13	0.51	6.09
	0700	0.10	11.13	0.29	11.13	0.31	11.13	0.36	11.13
	1300	0.16	2.10	0.37	10.67	0.35	11.13	0.44	10.67
	1900	0.27	12.80	0.37	12.80	0.38	12.80	0.39	11.64
31	0100	0.27	5.95	0.48	11.64	0.47	11.64	0.67	6.24
	0700	0.90	7.31	0.69	6.92	0.72	7.11	1.24	6.77
	1300	0.84	4.57	1.24	4.92	1.31	4.92	1.57	5.12
	1900	0.69	4.49	0.73	4.74	0.70	4.66	0.81	4.74
	Mean	0.72	8.19	0.93	9.34	0.95	9.30	1.17	8.92
	Std dev	0.43	2.71	0.49	2.57	0.50	2.42	0.59	2.48

* Electronic problems

(Sheet 2 of 2)

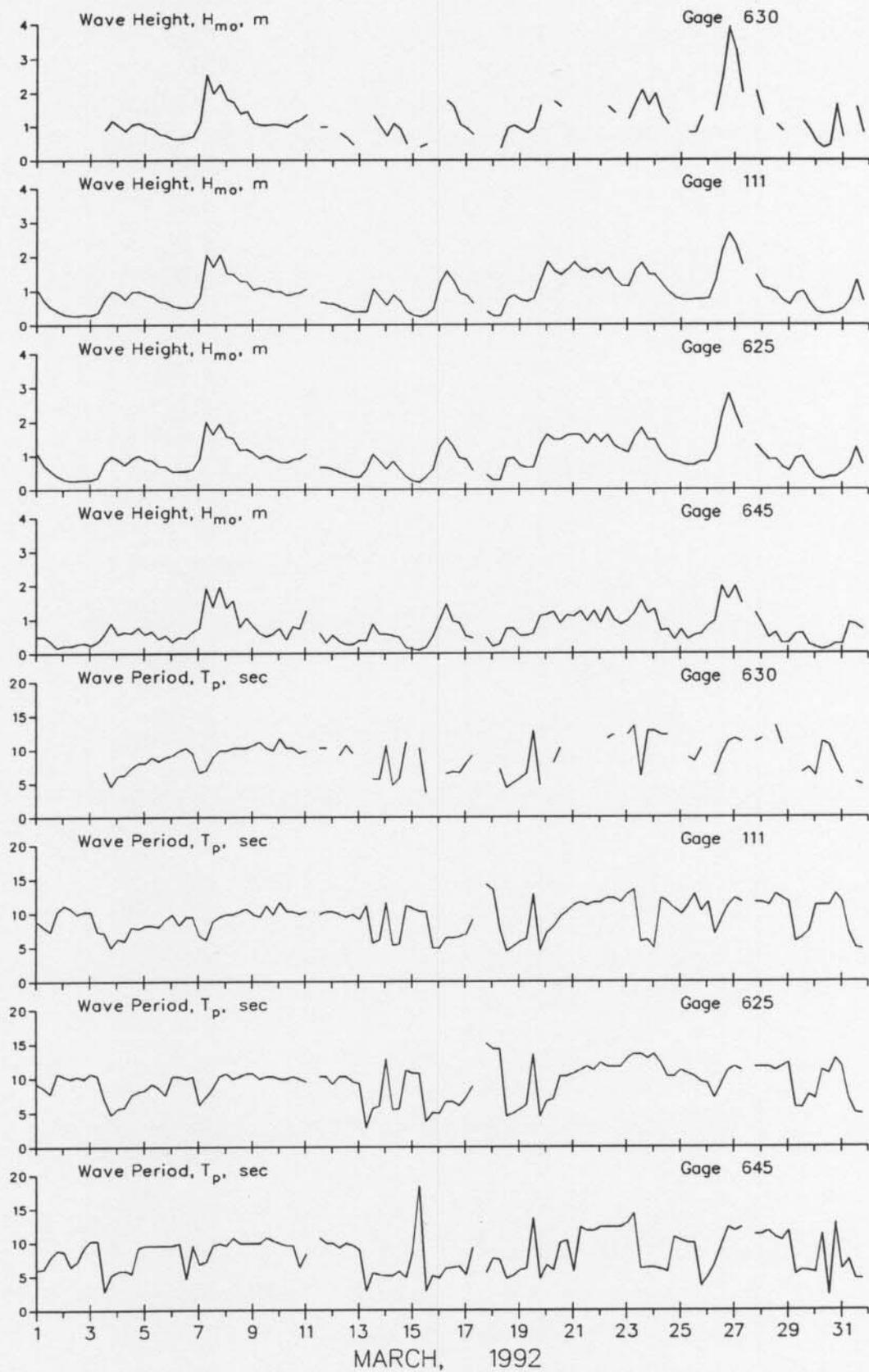


Figure 3. Time history of wave heights and periods

PART IV: CURRENT DATA

Current data (Table 4) are collected from a Marsh-McBirney electromagnetic biaxial current meter (Table 1 and Figure 2) and by visually observing the movement of dye on the water surface in the surf and at the seaward end of the pier, as well as 500 m updrift of the pier 12 m offshore.

Since the shoreline orientation is approximately N20W, longshore currents flow either toward 340 deg (i.e. northward) or toward 160 deg (i.e. southward). Similarly, cross-shore currents are either onshore (westward) or offshore (eastward).

All current speeds are given in centimeters per second (cm/sec). Resultant speeds and directions are determined by vector averaging the data.

Table 4: Current Data
Mar 1992

Day	Time	Alongshore Cross-shore Resultant	Pier Measurements			Beach Measurements (500m Updrift)			Current Meter 0.9 km Offshore Depth -5.6m (NGVD) ID #519		
			Dye at (579 m) (surface) Speed	Dir	Dye at Mid-Surf Zone (surface) Distance from Baseline (m)	Speed	Dir	Location	Speed	Dir	Speed
1	0100	-Along Cross Result								16 5 17	S off 142
1	0700	-Along Cross Result	6 7 9	N off 30	177	12 12 17	S off 115	North	16 S	8 2 8	S off 147
1	1300	-Along Cross Result								12 7 13	N on 311
1	1900	-Along Cross Result								9 4 10	N on 315
2	0100	-Along Cross Result								11 6 13	N on 313
2	0700	-Along Cross Result	2 9 10	N off 57	140	0 10 10	off 70	South	20 N	8 3 8	N on 320
2	1300	-Along Cross Result								6 2 6	N on 317
2	1900	-Along Cross Result								6 3 7	S off 137
3	0100	-Along Cross Result								10 2 10	S off 148
3	0700	-Along Cross Result	8 7 11	S off 118	140	0 3 3	off 70	North	5 S	9 3 10	S off 143
3	1300	-Along Cross Result								23 10 25	S off 138
3	1900	-Along Cross Result								33 11 35	S off 141
4	0100	-Along Cross Result								28 14 31	S off 133
4	0700	-Along Cross Result	24 2 25	S on 166	128	30 6 31	S on 171	North	13 S	24 11 27	S off 136
4	1300	-Along Cross Result								29 12 31	S off 138
4	1900	-Along Cross Result								31 16 35	S off 133
5	0100	-Along Cross Result								26 12 29	S off 135
5	0700	-Along Cross Result	34 0 34	S on 160	140	14 0 14	S on 160	North	9 S	31 5 31	S off 150
5	1300	-Along Cross Result								18 6 19	S off 143
5	1900	-Along Cross Result								18 4 18	S off 146

KEY = All speeds in cm/sec
N = Northward, Shore parallel
S = Southward, Shore parallel
on = onshore off = offshore

Table 4: Current Data (Continued)
Mar 1992

Day	Time	Alongshore Cross-shore Resultant	Pier Measurements					Beach Measurements (500m Updrift)			Current Meter 0.9 km Offshore Depth -5.6m (NGVD) ID #519	
			Dye at (579 m) (surface)		Dye at Mid-Surf Zone (surface) Distance from Baseline (m)		Dye 12m offshore (surface)			Speed	Dir	
			Speed	Dir	Speed	Dir	Location	Speed	Dir			
6	0100	-Along Cross Result									13 4 13	S off 141
6	0700	-Along Cross Result	13 8 15	S on 191	140	0 3 3		on 250	North	11	2 0 2	S 160
6	1300	-Along Cross Result									12 2 12	S off 151
6	1900	-Along Cross Result									2 1 2	S 160
7	0100	-Along Cross Result									14 4 15	S off 144
7	0700	-Along Cross Result	68 0 68	N 340	201	68 0 68	N 340		South	66	37 10 38	N on 325
7	1300	-Along Cross Result									11 11 16	N on 294
7	1900	-Along Cross Result									4 0 4	N 340
8	0100	-Along Cross Result									4 9 10	S off 95
8	0700	-Along Cross Result	0 0 0		179	18 6 19	N off 357		South	33	16 2 16	N on 335
8	1300	-Along Cross Result									5 7 8	N off 35
8	1900	-Along Cross Result									13 6 14	N on 317
9	0100	-Along Cross Result									11 2 12	N on 330
9	0700	-Along Cross Result	3 0 3	N 340	140	44 0 44	N 340		South	15	11 3 11	N on 325
9	1300	-Along Cross Result									4 4 6	S off 112
9	1900	-Along Cross Result									3 2 4	N on 310
10	0100	-Along Cross Result									1 0 1	N 340
10	0700	-Along Cross Result	13 4 14	N off 357	134	61 0 61	N 340		South	28	4 2 5	S on 190
10	1300	-Along Cross Result										
10	1900	-Along Cross Result										

KEY = All speeds in cm/sec
N = Northward, Shore parallel
S = Southward, Shore parallel
on = onshore off = offshore

Table 4: Current Data (Continued)
Mar 1992

Day	Time	Alongshore Cross-shore Resultant	Pier Measurements					Beach Measurements (500m Updrift)			Current Meter 0.9 km Offshore Depth -5.6m (NGVD) ID #519	
			Dye at (579 m) (surface)		Dye at Mid-Surf Zone (surface) Distance from Baseline		Dye 12m offshore (surface)			Speed Dir		
			Speed	Dir	Speed	Dir	Location	Speed	Dir	Speed	Dir	
11	0100	-Along Cross Result										
11	0700	-Along Cross Result	14 28 32	S off 97	134	55 0 55	N	South	24	S		
11	1300	-Along Cross Result									7 0 7	S 160
11	1900	-Along Cross Result									16 3 16	S off 149
12	0100	-Along Cross Result									8 2 8	S off 146
12	0700	-Along Cross Result	0 6 6	off 70	140	61 24 66	S on 182	South	0		2 2 3	S off 114
12	1300	-Along Cross Result									7 8 11	N on 293
12	1900	-Along Cross Result									12 4 12	N on 323
13	0100	-Along Cross Result									13 4 13	N on 323
13	0700	-Along Cross Result	6 2 6	S on 174	140	68 68 96	S on 205	North	30	S	4 1 4	N off 351
13	1300	-Along Cross Result									10 4 11	S off 138
13	1900	-Along Cross Result									7 5 8	S off 122
14	0100	-Along Cross Result									5 1 5	N on 331
14	0700	-Along Cross Result	17 0 17	S 160	180	61 27 67	S on 184	North	43	S	17 6 18	S off 140
14	1300	-Along Cross Result									37 7 38	S off 150
14	1900	-Along Cross Result									26 9 28	S off 141
15	0100	-Along Cross Result									4 5 7	S off 112
15	0700	-Along Cross Result	44 4 44	S off 154	152	13 4 14	S on 177	North	21	S	3 4 5	S off 109
15	1300	-Along Cross Result									13 6 15	S off 137
15	1900	-Along Cross Result									17 7 18	S off 139

KEY = All speeds in cm/sec
N = Northward, Shore parallel
S = Southward, Shore parallel
on = onshore off = offshore

Table 4: Current Data (Continued)
Mar 1992

Day	Time	Alongshore Cross-shore Resultant ----- Time	Pier Measurements				Beach Measurements (500m Updrift)			Current Meter 0.9 km Offshore Depth -5.6m (NGVD) ID #519	
			Dye at (579 m) (surface)		Dye at Mid-Surf Zone (surface)		Dye 12m offshore (surface)			Speed	Dir
			Speed	Dir	Distance from Baseline (m)	Speed	Dir	Location	Speed		
16	0100	-Along Cross Result								32 10 33	S off 142
16	0700	-Along Cross Result	76 0 76	S off 160	140	122 0 122	S off 160	North	38	48 16 51	S off 142
16	1300	-Along Cross Result								45 13 46	S off 144
16	1900	-Along Cross Result								35 10 37	S off 144
17	0100	-Along Cross Result								13 6 15	S off 136
17	0700	-Along Cross Result	25 15 30	N off 11	140	55 0 55	N off 340	South	9	5 7 8	N on 287
17	1300	-Along Cross Result									
17	1900	-Along Cross Result								4 4 6	N on 294
18	0100	-Along Cross Result								6 4 7	N on 303
18	0700	-Along Cross Result	9 3 9	S on 177	140	6 0 6	S off 160	North	6	1 0 1	N on 340
18	1300	-Along Cross Result								9 13 15	S off 105
18	1900	-Along Cross Result								4 9 10	S off 92
19	0100	-Along Cross Result								8 1 8	S on 169
19	0700	-Along Cross Result	12 3 12	N off 357	140	8 2 8	N off 354	South	0	2 4 4	N on 274
19	1300	-Along Cross Result								3 5 6	N on 277
19	1900	-Along Cross Result								35 12 37	S off 141
20	0100	-Along Cross Result								56 19 59	S off 141
20	0700	-Along Cross Result	51 15 53	S on 177	140	102 0 102	S off 160	South	91	36 13 38	S off 140
20	1300	-Along Cross Result								34 13 37	S off 139
20	1900	-Along Cross Result								33 12 35	S off 140

KEY = All speeds in cm/sec
N = Northward, Shore parallel
S = Southward, Shore parallel
on = onshore off = offshore

Table 4: Current Data (Continued)
Mar 1992

Day	Time	Alongshore Cross-shore Resultant ---- Time	Pier Measurements					Beach Measurements (500m Updrift)			Current Meter 0.9 km Offshore Depth -5.6m (NGVD) ID #519	
			Dye at (579 m) (surface)		Dye at Mid-Surf Zone (surface) Distance from Baseline (m)		Dye 12m offshore (surface)			Speed	Dir	
			Speed	Dir	Speed	Dir	Location	Speed	Dir	Speed	Dir	
21	0100	-Along Cross Result									39 15 42	S off 140
21	0700	-Along Cross Result	16 5 17	S off 143	189	44 26 51	S off 129	North	24	S	17 6 18	S off 142
21	1300	-Along Cross Result									18 9 20	S off 134
21	1900	-Along Cross Result									24 8 25	S off 142
22	0100	-Along Cross Result									21 10 23	S off 134
22	0700	-Along Cross Result	20 6 21	N on 323	213	25 0 25	S on 160	South	39	N	7 4 8	S off 133
22	1300	-Along Cross Result									4 3 5	S off 126
22	1900	-Along Cross Result									8 8 11	N on 294
23	0100	-Along Cross Result									1 3 3	N on 267
23	0700	-Along Cross Result	76 0 76	S 160	177	152 0 152	S 160	North	35	S	22 13 26	S off 129
23	1300	-Along Cross Result									55 19 58	S off 141
23	1900	-Along Cross Result									34 12 36	S off 140
24	0100	-Along Cross Result									43 15 46	S off 140
24	0700	-Along Cross Result	30 0 30	S 160	140	55 11 57	S on 171	North	49	S	25 10 27	S off 139
24	1300	-Along Cross Result									20 9 22	S off 136
24	1900	-Along Cross Result									8 5 10	S off 130
25	0100	-Along Cross Result									0 1 1	off 70
25	0700	-Along Cross Result	9 3 9	N on 323	140	61 6 61	S on 166	South	3	N	8 5 9	N on 309
25	1300	-Along Cross Result									8 2 8	N off 351
25	1900	-Along Cross Result									16 4 17	N on 326

KEY = All speeds in cm/sec
N = Northward, Shore parallel
S = Southward, Shore parallel
on = onshore off = offshore

Table 4: Current Data (Continued)
Mar 1992

Day	Time	Alongshore Cross-shore Resultant	Pier Measurements				Beach Measurements (500m Updrift)			Current Meter 0.9 km Offshore Depth -5.6m (NGVD) ID #519	
			Dye at (579 m) (surface) Speed	Dir	Dye at Mid-Surf Zone (surface) Distance from Baseline (m)	Speed	Dir	Dye 12m offshore (surface) Location	Speed	Dir	Speed
26	0100	-Along Cross Result								10 3 10	N on 321
26	0700	-Along Cross Result	34 8 35	N on 326	140	203 61 212	N on 323	18 N South	0 2 2	0 2 2	N on 250
26	1300	-Along Cross Result								10 3 10	N off 355
26	1900	-Along Cross Result								1 7 7	N on 260
27	0100	-Along Cross Result								7 5 9	N on 302
27	0700	-Along Cross Result	41 0 41	N 340	140	76 46 89	N on 309	21 N South	7 5 9	7 5 9	N on 303
27	1300	-Along Cross Result									
27	1900	-Along Cross Result								13 1 13	N off 346
28	0100	-Along Cross Result								9 3 10	S on 176
28	0700	-Along Cross Result	29 3 29	S off 154	203	0 23 23	off 70	20 S North	27 8 28	27 8 28	S off 144
28	1300	-Along Cross Result								22 12 25	S off 130
28	1900	-Along Cross Result								16 7 17	S off 138
29	0100	-Along Cross Result								6 2 6	S off 143
29	0700	-Along Cross Result	29 0 29	S 160	191	29 9 30	S on 177	74 S North	7 5 8	7 5 8	S off 124
29	1300	-Along Cross Result								1 7 7	S off 79
29	1900	-Along Cross Result								7 5 8	N on 306
30	0100	-Along Cross Result								11 6 13	N on 310
30	0700	-Along Cross Result	7 2 7	N off 354	140	0 2 2	off 70	7 N South	5 2 5	5 2 5	N on 320
30	1300	-Along Cross Result								6 1 6	N on 330
30	1900	-Along Cross Result								1 4 4	N on 259

KEY = All speeds in cm/sec
N = Northward, Shore parallel
S = Southward, Shore parallel
on = onshore off = offshore

Table 4: Current Data (Concluded)
Mar 1992

Day	Time	Alongshore Cross-shore Resultant ----- Time	Pier Measurements					Beach Measurements (500m Updrift)			Current Meter 0.9 km Offshore Depth -5.6m (NGVD) ID #519		
			Dye at (579 m) (surface)		Dye at Mid-Surf Zone (surface) Distance from Baseline (m)	Speed Dir		Location	Dye 12m offshore (surface)		Speed	Dir	
			Speed	Dir		Speed	Dir		Speed	Dir			
31	0100	-Along Cross Result								7	N	1	on
31	0700	-Along Cross Result	3	N	140	20	N	South	7	N	4	0	N
31	1300	-Along Cross Result	2	off		0					4	4	340
31	1900	-Along Cross Result	4	4		20	340				30	11	S
											32	21	off
											23	9	140
												21	S
												9	off
												23	136

KEY = All speeds in cm/sec
 N = Northward, Shore parallel
 S = Southward, Shore parallel
 on = onshore off = offshore

PART V: SUPPLEMENTAL OBSERVATIONS

Visual wave direction measurements (Table 5) of both the primary wave train (i.e. that having the larger wave heights) and the secondary wave train (which must be clearly distinguishable as a wave train separate from the primary waves but not surface chop or capillary waves) are taken daily at the seaward end of the pier. The direction of the primary wave train just north of the seaward end of the pier is also determined using a Raytheon Marine Pathfinder radar and measuring the alignment of the wave crests at approximately the same location as the visual measurements. The pier axis (considered perpendicular to the beach at the FRF) is orientated 70 deg east of true north; consequently, wave angles greater than 70 deg indicate that the waves were coming from the south side of the pier.

The width of the surf zone (seawardmost breaker position to shoreline) is determined from the pier deck.

Measurements of surface water temperature, density, and visibility are also taken daily at the seaward end of the pier. A jar along with a thermometer is lowered about 0.3 m into the water and allowed to remain for at least one minute. The jar is removed, the temperature read, and a hydrometer is used to determine the density. A Secchi disc is used to determine the surface visibility.

Table 5: Supplemental Observations

Mar 1992

Day	Time	Wave Approach Angle at Pier End deg from True N		Radar Wave Angle deg from True N	Width of Surf Zone, m	Water Characteristics at Pier End		
		Primary	Secondary			Temp., C	Density g/cc	Secchi Vis., m
1	0915	35	145		53	7.2		1.5
2	0814	125			8	6.1	Hyro- meter	3.0
3	0812	50	135		5	7.8	broken	3.0
4	0756	35		50	46	6.7		3.0
5	0753	50		60		6.7	1.0226	2.4
6	0809	100			53	8.9	1.0224	3.0
7	0835	105		105	79	8.3	1.0240	1.8
8	0915	80			72	8.9	1.0243	2.7
9	0813	95			92	10.0	1.0242	2.7
10	0709	100			51	10.6	1.0241	2.1
11	0705	100		100	37	8.8	1.0252	0.9
12	0809	none	visible		40	7.8	1.0254	1.2
13	0758	45		100	43	8.3	1.0256	1.5
14	0915	20			55	8.3	1.0256	1.8
15	0920	none	visible		16	8.3	1.0234	2.4
16	0806	50		40	205	7.8	1.0228	1.2
17	0809	80		80	38	8.3	1.0228	1.2
18	0813	50	80		21	8.3	1.0252	3.4
19	0807	55			24	8.9	1.0249	1.8
20	0824	40		90	103	8.3	1.0241	1.5
21	0930	30			76	8.3	1.0234	2.7
22	0900	75	110	80	96	8.3	1.0234	1.2
23	0730	80	50	75	143	7.8	1.0238	0.3
24	0803	45		60	91	7.8	1.0241	1.2
25	0719	85			69	7.8	1.0238	1.2
26	0807	100		110	232	8.3	1.0245	2.1
27	0705	80			400	8.3	1.0258	0.9
28	0925	85	20		94	8.3	1.0260	0.9
29	0930	45	130	40	63	8.3	1.0250	3.0
30	0743	none	visible		31	8.9	1.0250	1.5
31	0844	85			55	8.9	1.0249	2.1

PART VI: WATER LEVELS

Since 1978, the National Oceanic and Atmospheric Administration (NOAA)/National Ocean Service (NOS) has operated a primary tide station (No. 865-1370) at the seaward end of the FRF pier. A Leupold-Stevens digital recording float-type tide gage is used to collect instantaneous water level data every 6 minutes throughout the month.

The variation in water level during the month is shown in Figure 4 along with a list of mean and extreme values. This presentation is useful in identifying effects of both meteorological and astronomical forces on the open coast water level.

Table 6 contains the time at the center of each 12.42-hr tidal cycle and the range, high, low, and mean water levels during each tidal cycle.

FRF Tide Heights

Mar 1992

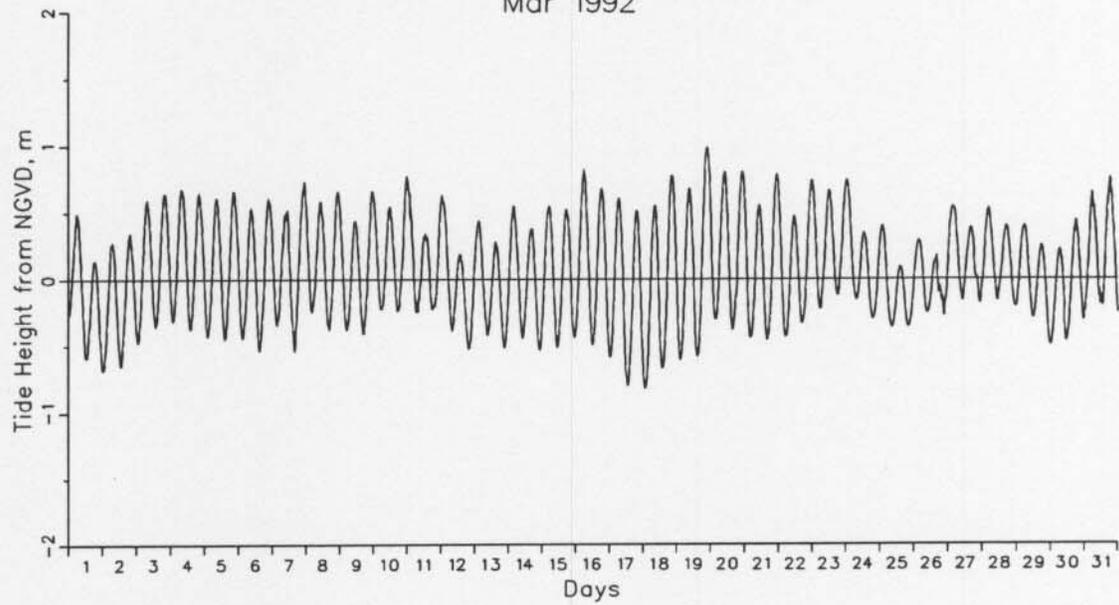


Figure 4. Water level time history

Monthly Water Levels, m NGVD

Extreme Low = -0.82 on day 18 at 54 EST
Extreme High = 0.99 on day 19 at 2048 EST
Monthly Mean = 0.07
Mean Low = -0.41
Mean High = 0.54
Mean Range = 0.95

Table 6: Water Levels, m NGVD

		Mar 1992			
Mid-Cycle Day	Time	Low	High	Mean	Range
1	823	-0.59	0.49	0.00	1.09
1	2049	-0.69	0.14	-0.27	0.82
2	914	-0.66	0.27	-0.19	0.93
2	2139	-0.56	0.34	-0.10	0.90
3	1004	-0.36	0.60	0.10	0.96
3	2230	-0.32	0.64	0.16	0.96
4	1055	-0.37	0.68	0.17	1.05
4	2320	-0.43	0.65	0.12	1.08
5	1145	-0.45	0.61	0.08	1.06
6	10	-0.44	0.66	0.11	1.10
6	1236	-0.54	0.53	0.01	1.07
7	101	-0.34	0.60	0.12	0.95
7	1326	-0.54	0.52	0.03	1.05
8	151	-0.25	0.73	0.22	0.98
8	1416	-0.38	0.59	0.10	0.97
9	242	-0.38	0.66	0.14	1.04
9	1507	-0.41	0.44	0.02	0.85
10	332	-0.22	0.66	0.20	0.88
10	1557	-0.24	0.54	0.14	0.78
11	422	-0.25	0.77	0.27	1.02
11	1648	-0.23	0.34	0.05	0.56
12	513	-0.38	0.63	0.16	1.01
12	1738	-0.52	0.19	-0.15	0.71
13	603	-0.42	0.44	0.02	0.86
13	1828	-0.52	0.28	-0.11	0.80
14	654	-0.44	0.55	0.06	0.99
14	1919	-0.53	0.38	-0.05	0.91
15	744	-0.51	0.55	0.04	1.06
15	2009	-0.44	0.52	0.02	0.96
16	834	-0.49	0.82	0.18	1.32
16	2059	-0.59	0.68	0.06	1.26
17	925	-0.80	0.61	-0.06	1.41
17	2150	-0.82	0.51	-0.17	1.34
18	1015	-0.77	0.55	-0.11	1.32
18	2240	-0.61	0.78	0.09	1.39
19	1105	-0.58	0.68	0.02	1.26
19	2331	-0.49	0.99	0.31	1.48
20	1156	-0.38	0.80	0.21	1.19
21	21	-0.44	0.81	0.19	1.25
21	1246	-0.46	0.55	0.02	1.01
22	111	-0.43	0.79	0.18	1.22
22	1337	-0.42	0.47	0.02	0.90
23	202	-0.26	0.74	0.24	1.00
23	1427	-0.15	0.67	0.24	0.82
24	252	-0.15	0.74	0.32	0.90
24	1517	-0.30	0.35	0.03	0.64
25	343	-0.36	0.40	0.03	0.76
25	1608	-0.36	0.09	-0.15	0.45
26	433	-0.33	0.29	0.01	0.62
26	1658	-0.28	0.18	-0.07	0.45
27	523	-0.16	0.55	0.22	0.71
27	1749	-0.18	0.38	0.11	0.56
28	614	-0.16	0.53	0.18	0.69
28	1839	-0.21	0.40	0.12	0.61
29	704	-0.29	0.40	0.09	0.69
29	1929	-0.50	0.25	-0.07	0.75
30	755	-0.49	0.22	-0.13	0.72
30	2020	-0.37	0.45	0.04	0.82
31	845	-0.20	0.66	0.18	0.86
31	2110	-0.25	0.77	0.30	1.02

PART VII: NEARSHORE PROFILES

A. Nearshore Profiles. In order to document profile response away from the pier, surveys of four profile lines extending 900 to 1,000 m from shore and located 489 and 581 m north and 517 and 608 m south of the FRF pier are conducted bi-weekly, after storms, and during more complete bathymetric surveys.

These profiles are obtained using the CRAB-Geodimeter surveying system; a Geodimeter 140-T self-tracking, electronic theodolite, distance meter, in combination with the Coastal Research Amphibious Buggy (CRAB), a 10.7 m high, self-powered, mobile tripod on wheels.

Figure 5 shows the last survey in February 1992 and the surveys in March 1992 on profile line 188, located 517 m south of the pier.

The profile envelope (Figure 6) reflects the maximum changes that occurred on the profile during 1992. Cross-hatched areas indicate changes to the annual envelope which occurred in March.

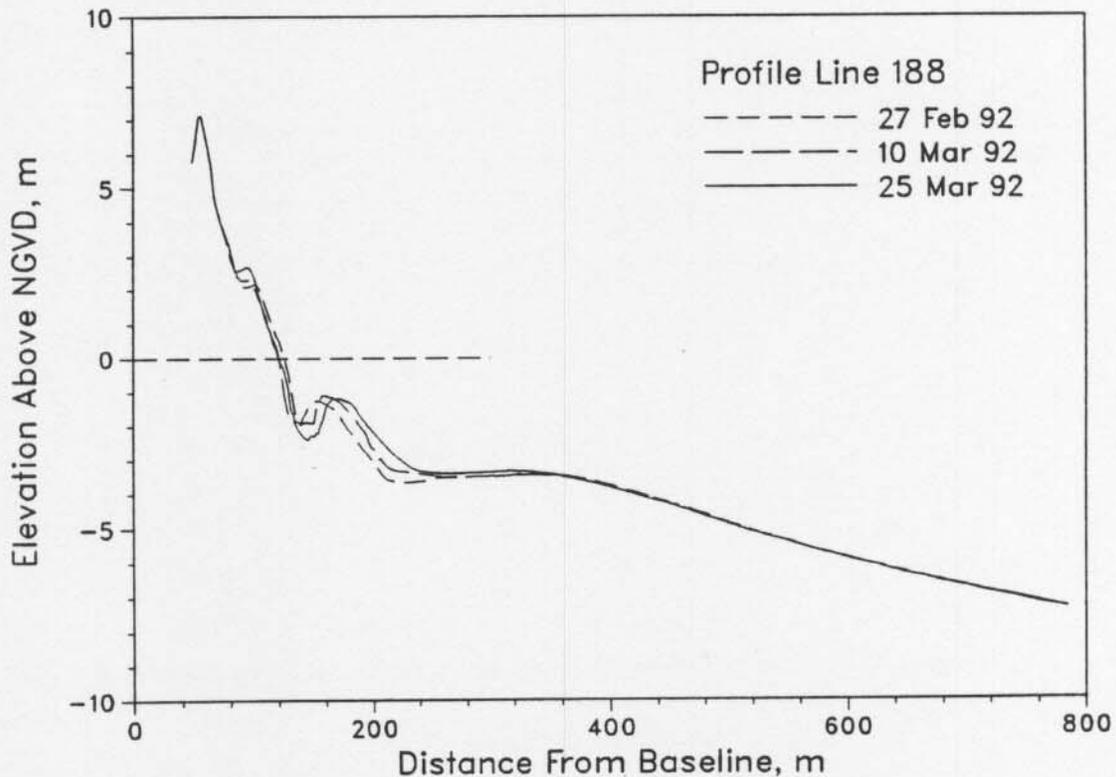


Figure 5. Monthly CRAB profiles on profile 188 - 517 m south of pier.

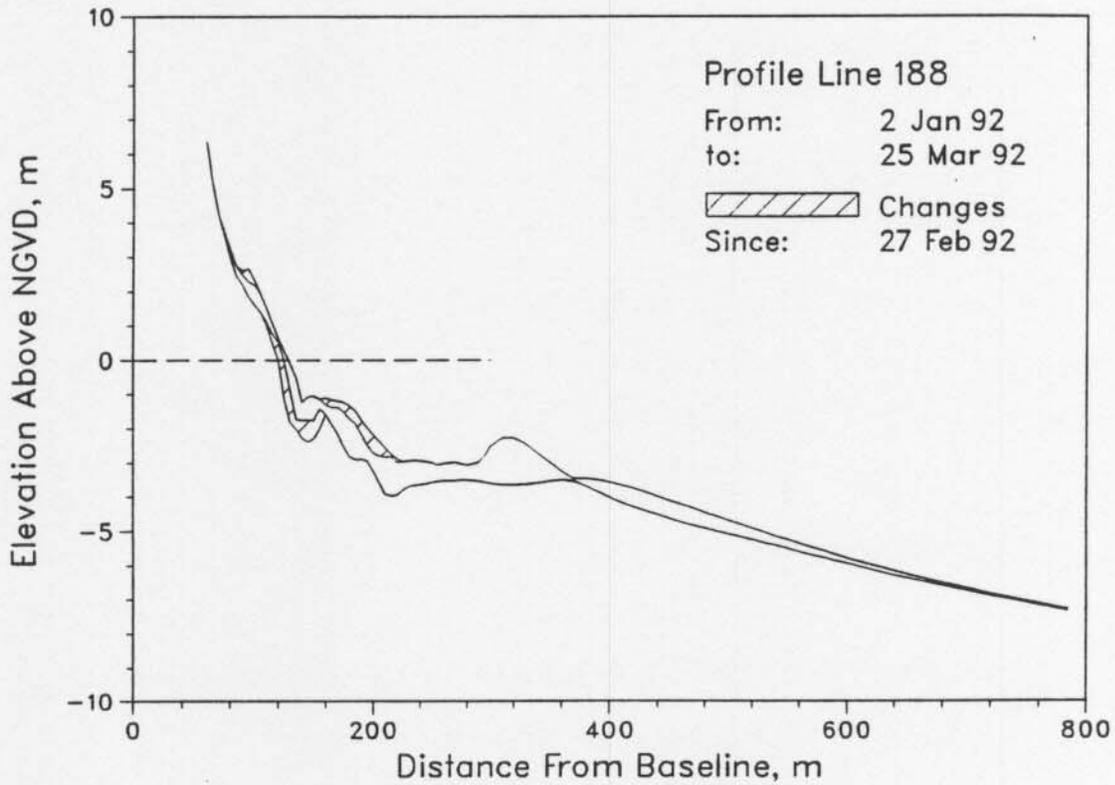


Figure 6. CRAB profile envelope - profile 188.

B. Bathymetry. Figure 7 includes a two- and three-dimensional contour map and a change plot derived from the bathymetric survey on 25 March. Wide contour lines on the change diagram represent eroded areas; thin lines indicate deposition.

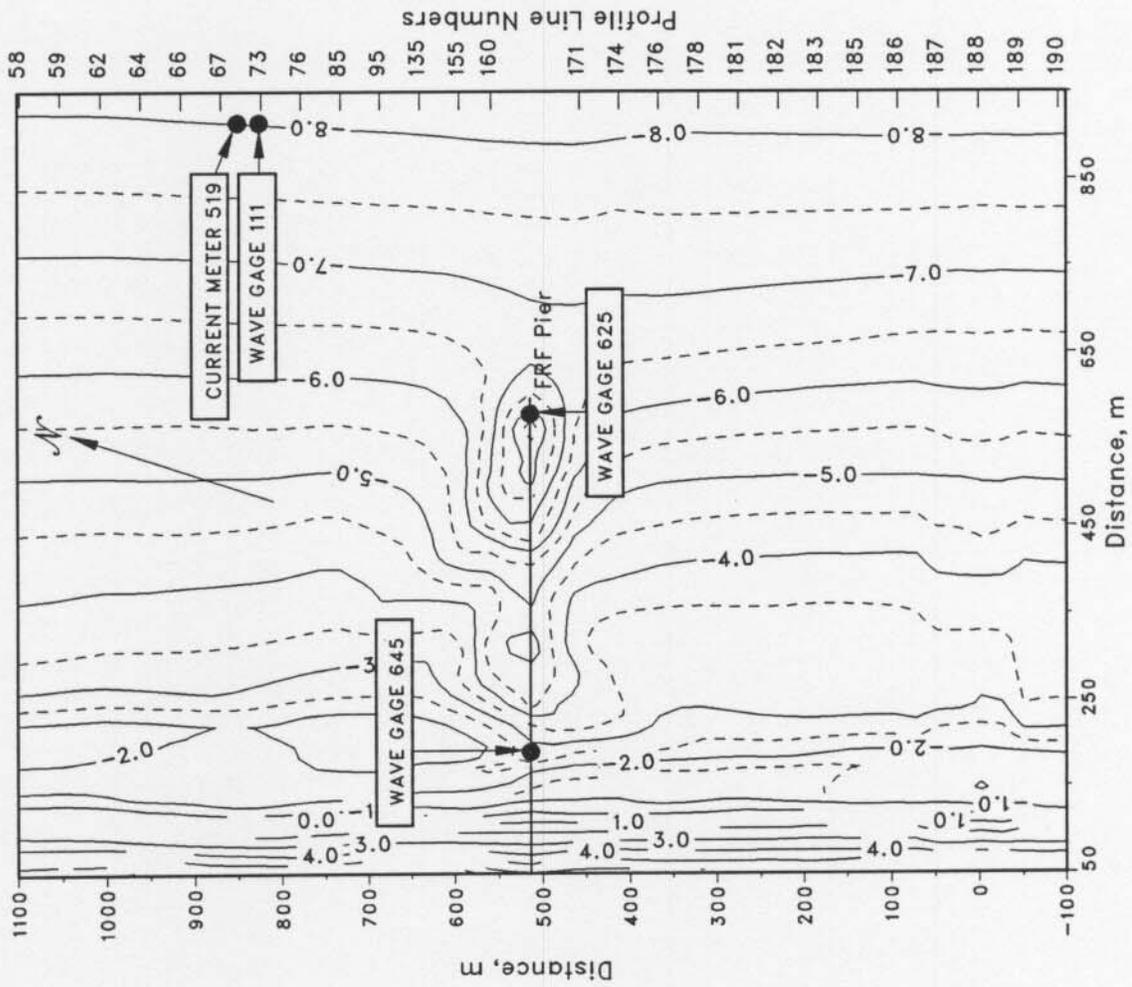
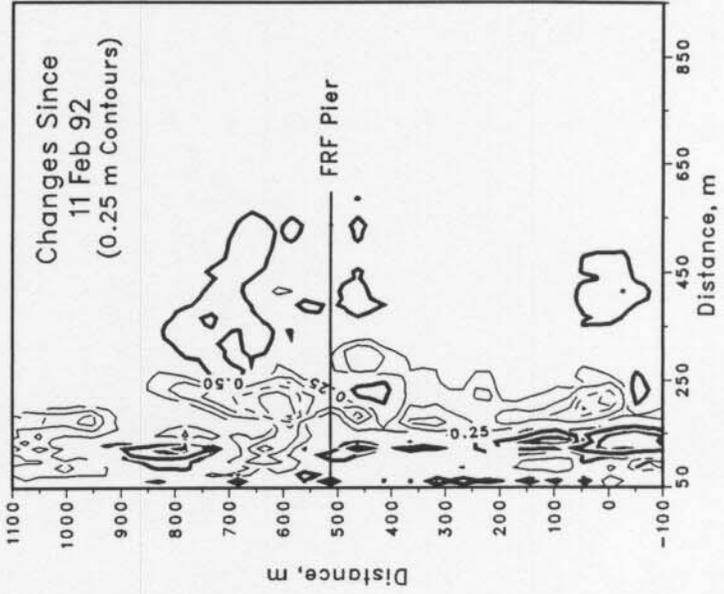
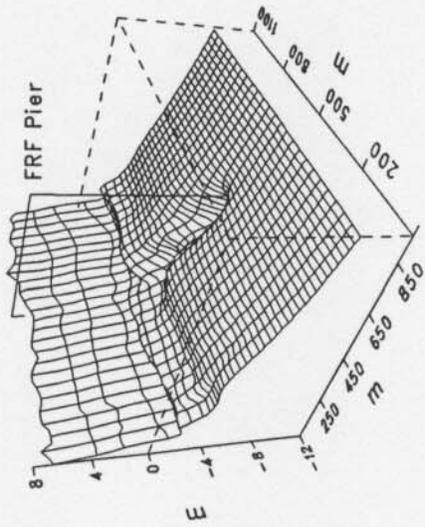


Figure 7. FRF bathymetry 25 Mar 92 depths relative to NGVD

PART VIII. SPECIAL EVENTS

A. Storm Data Collection. The following list identifies times when the wave height H_{mo} at the seaward end of the pier (i.e. as measured near the end of the pier) exceeded 2 m.

<u>Start</u>	<u>End</u>
26 Mar (1216)	27 Mar (0100)

B. Storm Synopsis.

On the morning of 26 March, a low pressure system associated with a cold front formed along the North Carolina coast. By 27 March, the storm had moved north and inland over New England. The maximum H_{mo} (at gage 625) of 3.2 meters ($T_p = 11.6$ sec) occurred at 1634 EST on 26 March. Maximum winds (from northeast) reached 9.8 m/s on 26 March at 0842 EST. The minimum atmospheric pressure of 999.4 mb was measured at 1442 EST also on 26 March. Total precipitation was 39 mm.

Distribution List

Government Agencies:

OCE	U.S. Geological Survey
BERH	U.S. National Park Service
NAO	U.S. Naval Academy
NASA/Wallops Flight Center	U.S. Naval Civil Eng. Lab
NOAA (NOS, NWS)	U.S. Naval Fac. Eng. Com.
SAD	U.S. Naval Oceanographic Off.
SAW	U.S. Naval Research Lab

Colleges/Universities:

California Inst. of Tech.	Stockton State College
East Carolina University	University of Akron
Florida Inst. of Tech.	University of Delaware
Harvard University	University of Florida
Naval Post Graduate School	University of Maryland
NC State University	University of Miami
Old Dominion University	University of North Carolina
Oregon State University	University of N. Colorado
Prince George's College	University of Rhode Island
Rutgers University	University of Virginia
Scripps Inst. of Oceanography	Va. Inst. of Marine Science
Southern Illinois University	

Others:

City of Va. Beach, VA	MEC Systems Corporation
Coastal Barge Corporation	Moffatt & Nichol, Eng.
Coastal and Est. Res., Inc.	Offshore Coastal Technologies
Coastal Science & Eng., Inc.	Mr. Rowland
Dr. Galvin	Mr. Savage
GEOMET Tech., Inc.	Sea Port Supply Corp.
Greenhorne & O'Mara, Inc.	Shell Development
Dr. Hylton	Sherwood Industries
Mary Marr, Inc.	Mr. & Mrs. Valpey
Mr. Mason	WCTI-TV
Masonite Corporation	SEASUN Power Systems

Foreign:

W. F. Baird & Asso. Coastal Engineers, Ltd (Canada)
Queen's University, Ontario (Canada)
Ministry of Construction, Coastal Division (Japan)
Norwegian Hydrodynamic Laboratories (Norway)
University of New South Wales (Australia)
University of Sydney (Australia)